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ACTORS FOR CONSIDERATION IN THE DESIGN AND CONSTRUCTION OF GLE VISION AND MULTIFOCAL LENSES

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FACTORS FOR CONSIDERATION IN THE DESIGN AND CONSTRUCTION OF SINGLE VISION AND MULTIFOCAL LENSES

FACTORS FOR CONSIDERATION IN THE DESIGN AND CONSTRUCTION OF SINGLE VISION AND MULTIFOCAL LENSES*

By Roy Marks‡
Rochester, N. Y.

SINGLE VISION LENSES

Much has been said and written concerning the relative merits of current lens products, both single vision and multifocal, produced by the major manufacturers. All of these products are good and perform their function as intended. No manufacturer ever started out deliberately to produce a second quality lens. Some second quality lenses are produced, however, by virtue of the lack of ability, on the part of the manufacturer, to set his sights high enough, from a standpoint of quality control and design.

It is not our purpose to disparage the efforts of others, but rather to set forth the concepts of lens manufacture, as conceived by our own company. There are two fundamental concepts to be considered, both of which contribute to the end product. They are Design and Construction. Let's apply them to our products.

WIDESITE SINGLE VISION LENSES

DESIGN

There are many scientific means of expressing the definition of a corrected curve lens. Books have been written about it, and by some very capable and learned authors. There is no attempt here, to produce a scientific tome, complete with the usual charts, drafts and mathematical formulae.

Basically, there are three ingredients that go into the production of any corrected lens. They are:

No. 1—Refractive index of the glass used.
No. 2—Thickness.
No. 3—Curvature of the front and back surface.

These three components, in the right balance, will produce a lens of a certain effective focal power. Let us analyze each individual component for a minute.

No. 1—Refractive Index

All single vision lenses manufactured in this country today, are made from a glass of the same index, namely, 1.523. Obviously, this is a "must," inasmuch as all grinding tools and gauges in all of the laboratories must be com-

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‡ Vice President for Sales, Shuron Optical Company, Inc.

puted on the same basic refractive index, in order to permit standardization of tools and machines.

Consequently, it would be extremely difficult to find any difference in lenses, based on this first component. Of course, there is a difference in glass quality, but that is another matter.

No. 2—Thickness

For all practical purposes, the thickness variations from one manufacturer's lens to another, can be ignored in this discussion. The prescribing doctor and the optician has pretty well established the thickness variations that are possible, and in the main, accepts the basic thickness of the manufacturer. These thicknesses may vary, depending on the philosophy of the corrected curve that the particular manufacturer is producing, but these variations are not too significant.

Consequently, it would be similarly difficult to look for a difference in corrected curve lenses by examining component No. 2.

No. 3—Curvature of the Front and Back Surface

With the index of refraction and thickness relatively fixed, the only variable factors that can produce variations in power are the curvatures of the front and back surface.

If the prime consideration in selecting our front and back surface was only the axial power, or the power through the center of the lens, we would still be using flat lenses. The power through the center of the flat was adequate for all purposes.

It is known, however, that the patient does not always look through the lens center, and in fact, he uses areas away from the center a good proportion of the time. When any other portion of the lens, away from the center, is used, variations in spherical and cylindrical power may be noted. These errors are generally referred to as spherical aberration and marginal astigmatism.

The PCX or 1.25 Base Curve lens was the first deviation from the "flat" and was an attempt to minimize these errors. The Six Base Lens, still in use, was a further attempt. However, it was not until the late 1920's that a really serious effort was made to eliminate them or to minimize them to a point where they ceased to interfere with good vision.

By the proper selection of the front and back curves for any particular power, these errors can be minimized to a point where they are no longer significant. This is the basis for the design of all present day corrected curve lenses.

All major companies, producing lenses today, have succeeded in producing a good lens from this point of view. While there may be slight variations in approach, Shuron has no quarrel with these. We feel that these other lenses are as good as Widesite in this area.

The Shuron Widesite lens series has been so computed as to minimize these marginal errors, in accordance with these basic premises, essential to high quality in a corrected curve lens. We are completely satisfied that in the area of design, no other commercially produced corrected curve lens series on the market today, performs this function any better than a Widesite lens.

CONSTRUCTION

It is in the area of construction that major manufacturing differences occur. There are 6 major factors that require consideration. These are:

No. 1—Focus accuracy.
No. 2—Edge and center thickness.
No. 3—Centering.
No. 4—Surface quality.
No. 5—Surface contour.
No. 6—Size.

Quite often, manufacturing concepts stress a combination of perhaps two or three of these factors, ignoring the others. It is Shuron's belief that unless all 6 factors are built into the product and specifications rigidly adhered to, a product is made that must be considered less than the best.

It is because these 6 factors are an integral part of each Widesite lens that we are convinced that Shuron Widesite lenses are the very finest available.

Let us, therefore, take a look at each of the 6 components. Before we examine them, however, let me point out to you that it must be recognized that regardless how rigidly standards are set up, the control of them are still in the hands of human beings. Human judgment errs from time to time, and as a result, it is impossible to categorically state that no lens is ever produced and shipped to the customer that does not conform 100% to the specifications set forth. The determining factor on how good the quality of a lens is, appears to me to be the recognition on the part of the company, of the need for setting up controls within certain limits, and doing everything in its power to rigidly adhere to them . . . This, Shuron has done, and by so doing, has produced what represents today, without question, the finest product made in the United States.

No. 1—Focus Accuracy

The specifications call for a maximum tolerance of .06 strong and .06 weak. Lenses varying from those tolerances are considered unfit for shipment. All manufacturing processes, as well as quality control systems are set up to maintain these standards. Lenses held to these specifications guarantee accurate interpretation of the prescribed lens power.

No. 2—Edge and Center Thickness

Center thickness is held within + .2mm., − .2mm. Edge thickness control is automatic, as all thickness computation is based on center thickness calculation. The adherence to this specification assures consistency of thickness and eliminates do-overs and specials, as a result of varying strap thickness on rimless and poor zylonite and metal inserts.

No. 3—Centering

Centering tolerances are held as closely as precision manufacturing methods permit. Widesite centering is equal to or better than other products.

However, with the introduction of the new Widesite 62, these tolerances become much more significant. Because of the new large size, large and odd lens shapes are easily cut out, and the minor centering variations that are common to all lenses, are no longer a problem with Widesite.

No. 4—Surface Quality

Specifications are so written so as to provide for maximum elimination of all surface flaws. Gray, scratches, abuse and other beauty marks are all rejectable. Bubbles, straie, and other internal glass faults are similarly unacceptable. This type of quality concept reduces do-overs in the shop as there will be a minimum number of lenses that need to be rejected in the last stages of Rx processing and the patient is sure of a flawless surface and internal quality.

No. 5—Contour Accuracy

This particular component of a lens, is probably the least talked about and the most ignored by many lens manufacturers. A lens may have absolutely flawless surface quality, may be centered properly, may have good thickness control, may be accurate focuswise, but may still be a highly objectionable product, as the result of aberration on the lens surface.

This is true of many lenses. One of the most outstanding tests that has ever been developed to discover lack of good contour in the lens, is an arc lamp or any pin point source of light that is projected through a lens surface on to a white screen. There, the variations in contour of surface immediately show up and the aberration patterns are clearly visible.

These aberration patterns are usually produced by poor machinery and improper standards set up in the initial stages of the grinding and polishing of the lenses.

Because the Shuron Optical Company has long been recognized as the number one designer and producer of fine lens grinding equipment in the United States, it is possible for us to produce a lens that has a contour accuracy and quality that is not approached by any other single vision lens on the market.

What are the problems arising from lens surfaces not similarly controlled? Because these aberrations are difficult to detect by the human eye, it is reasonable to assume that the human eye accommodates for them. In other words, they are not easy to see by ordinary visual methods. However, these irregularities on the front and back surface of the lens break up the light pattern to the extent that it is necessary for additional exertion, on the part of the eye, to be put forth by the individual looking through the lenses, in order to accommodate for or overcome them. This is an unnecessary hazard and produces less than a perfect image on the retina.

Shuron believes that this particular aberration is an insidious and a dangerous one, inasmuch as it is possible for manufacturers of lenses to ignore it in their processing, and thus, produce lenses that are sub-standard in quality, yet having flaws that are undetectable, but are as dangerous, or more so, in respect to human vision, than many of the more obvious defects.

No. 6—Size

Shuron's new 60 x 62 size, in its Widesite Lens Series, provides the largest maximum glass area possible, without any material increase in thickness. To produce a larger lens, in this size and range, would result in necessary thickness increases, making the finished product unuseable on the average Rx.

Approximately 75% of all single vision Rx's require lenses in the first division. Consequently, this maximum lens size has been confined to that group. Second division size changes are being made and will be produced in an optimum size, so as to maintain present thickness factors. Investigation shows that approximately 93% of all first division lenses can be processed from the new Widesite uncut lens.

Laboratory tests indicate that from 10 to 20% of the surface jobs now going into the shops, need no longer be processed from blanks, but can be produced from uncuts. All of these size factors add up to a lens providing maximum useability at minimum cost.

The speed of service is made possible by the lack of need to surface many prescriptions and is a big time and money saver in improved service at both the professional and laboratory levels.

As previously stated, Shuron believes that to produce the best possible lens, all six of these factors are vital.

Widesite construction concepts provide all six to the exclusion of all other lens products currently being marketed. Other manufacturers produce good lenses too. However, we believe that it is impossible to find any lens except Widesite, in which these factors are present, more consistently, day-in and day-out, and which provides the laboratory and professional man with a better answer to removing any doubt that he has provided the very best available in his lenses for his patient.

MULTIFOCAL LENSES

DESIGN

D SEG

The most popular segment is available in 4 segment sizes—20mm, 22mm, 25mm and 28mm. Functionally, all sizes of segs accomplish the same objective. The size variation provides a range of field sizes to enable the practitioner to select that size which is best suited to his individual patient's needs.

Let us examine the design of the D type seg closely. Primarily, it was designed to overcome two major deficiencies in the round (Kryp or Ultex) type, namely—

1—Improper placement of normal reading field.

2—Jump or image displacement.

1—IMPROPER PLACEMENT OF NORMAL READING FIELD.

A great deal of research has been done in this area and the facts are simple and complete.

Most of the basic investigation on preferred reading depths, has been conducted on people wearing single vision lenses. Obviously, because this type of patient has no segment to influence them, an accurate determination of the preferred position could be made. Two groups were selected for these tests—those who wore single vision lenses and a smaller group, who wore no glasses at all, but upon whom plano lenses could be placed. It was discovered that the average preferred reading depth by both groups was 8mm below the mechanical center of the lens.

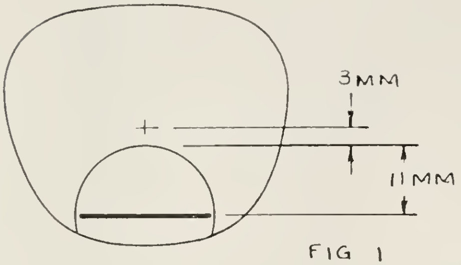


FIG 1

If you analyze a Kryptok, you will discover that the widest part of the segment and that which affords the best reading area is 11mm below the top of the seg—at the center of a 22mm segment. The average Kryptok is fitted 3mm below the mechanical center of the lens, thus placing the most comfortable reading area of the segment 14mm below the mechanical center of the major lens. (See Fig. 1)

If the preferred reading depth is 8mm, a patient wearing bifocals for the first time, must learn a new set of reading habits. Notice, if you will, any Kryptok wearer. The big majority always tilt their chins up and their heads back in an effort to use the best reading area of the Kryptok. This is an unnatural reading position and is the cause of considerable difficulty in becoming accustomed to bifocals.

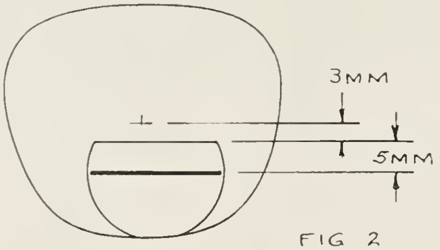


FIG 2

In designing the present day flat top segment, this was taken into consideration. The optical center of all D style segments (except the D-28) was placed at 5mm below the top line. Assuming the seg is to be placed 3mm below the geometrical center of the lens, we then have the widest and best portion of the segment at the preferred reading depth of 8mm. (See Fig. 2)

This means that a patient can "get used to" the bifocal much easier inasmuch as the widest and most useful portion of the segment is at the preferred reading depth.

The illustration below shows the relative position of reading fields in both lenses.

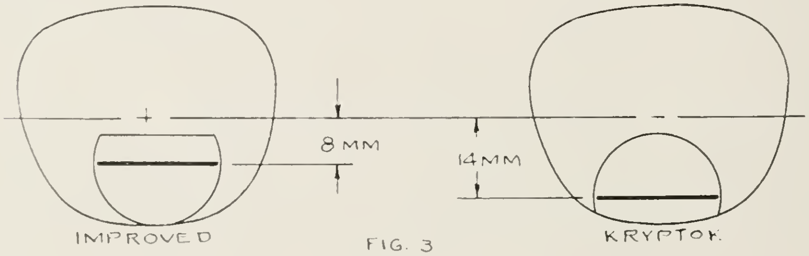


FIG. 3

It can, therefore, be said that the flat-top type of segment permits the patient to continue his natural reading habits because his reading field is at his preferred reading depth, rather than in a position that makes necessary an awkward and age divulging head mannerism.

Of secondary, but important, value is the straight top line of the segment. The round top of the Kryptok is disturbing because the first 3mm of the seg is valueless as a reading field. The straight top permits entry into an immediately useable area—eliminating any waste area. Actually, tests show that there is 22% more *useable* area in a 20mm D segment than in a 22mm Kryptok.

2—JUMP OR IMAGE DISPLACEMENT.

When a patient rotates his eyes downward through a single vision lens from the straight-forward position (through the O.C. of the distance portion) to the reading depth, he encounters no sharp image displacement. Although he encounters a displaced image at the reading level (amount and position dependent on the power of the distance) this displacement is a gradual one and one to which he has become accustomed. When he wears a bifocal, he encounters, for the first time, a "jump" of image at the position of entrance into the segment. The illustration below will help to clarify this.

In the Kryp illustrated in Fig. 4, consider the segment as a separate part of the distance portion, for a moment. If the power of the segment is 2.00D, then at a point 11mm from the O.C. of the + 2.00 sphere, there will exist 2.2 prism diopters, *base down.* If the eye is moving downward into the 22mm Kryp, it will encounter 2.2 degrees of prism base down at the upper margin of the seg. If a patient has worn a single vision lens for some time prior to wearing bifocals, the displacement of object caused by this prism has never been present before, and as a result, the confusion and dissimilarity of normal reading pattern will be troublesome. This unwanted condition, or "jump," is a hazard and a deterrent to easy use of the lens. It is something else to "get used to."

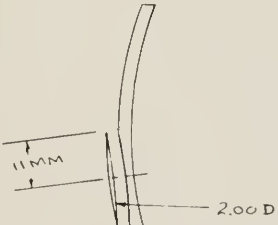


FIG 4

The ideal segment to eliminate jump, therefore, would be one in which the optical center was placed at the top line, or top margin. At that point, there would be zero decentration of the segment and no prism.

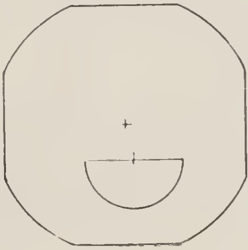


FIG 5

However, the patient would then find an ever-narrowing reading field as the eye moved downward into the reading field, thus causing another difficulty.

This might be overcome by making the segment extremely large, but in doing this, the seg would be unsightly and thick, making necessary heavier lenses. Also, an induced prism would be present at the reading level (5mm below the top of the seg) introducing another factor that might be troublesome.

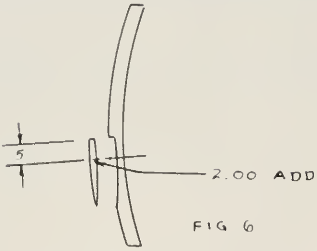


FIG 6

After considerable study, it was indicated that the minimum "jump" induced by the D style seg was preferred to the other difficulties. Consider Fig. 6.

With the same 2.00 D add in the D seg, only 2.00 x .5mm or 1 degree of prism exists as compared with the Kryptok prism of 2.2 degrees.

In an "A" style Ultex, with an O.C. 19mm below the top edge of the seg, we have 2.00 x 1.9 or 3.8 degrees of jump.

So, of all bifocal types, the D style provides the best solution.

1—Minimum jump at the top edge of the segment.
2—No contributing prism at the preferred reading depth.

It can be said, therefore, that the D style segment provides the patient with as close to a continuation of his natural and normal reading habits as is practical with—

1—Widest reading area at preferred reading depth.
2—Immediately useful reading area upon entrance into seg.
3—Minimum practical "jump" or image displacement.

While still on the subject of prism and displacement, there are some who still hold to the theory that different styles of segments should be prescribed for different distance corrections i.e. heavy plus—an Ultex A. The theory is that the great amount of base down prism in the Ultex segment neutralizes the base up prism in the distance. A lesser plus distance would call for a Kryptok and a plano distance or minus Rx would require a D type straight top. Theoretically, these various approaches are supposed to produce a resultant "zero" prism at the reading depth. The facts are that although theoretically, this is *partly* true, the patient prefers the wide field of vision, minimum jump and ease of entry into the seg to the questionable compensation for a prism factor he has not found troublesome in the past. If he has worn a heavy plus for a long time, the chances are he has become accustomed to the base up prism at his reading level caused by his distance Rx. When properly fitted with a D type seg, he notices no change in prism factor as he is looking through the O.C. of the seg and at that point, the seg contributes no prism, thus enabling him to continue his normal previous reading habits.

B SEGMENT

The Shuron B seg is specialized in use. It has been designed to give the patient maximum distance vision when minimum reading area is indicated. It is especially designed for farmers, railroad workers and other outdoor people who perform an occasional reading task and a major walking or riding job that requires distance area under the segment and at the sides. When properly fitted, it is ideal for this purpose.

The segment can be made from 19mm to 22mm wide. It has a standard vertical height of 9mm.

It has the same minimum jump, wide reading area and ease of entry into the segment as does the D style.

It should never be fitted to anyone unless at least 8mm of distance area can be provided beneath the segment.

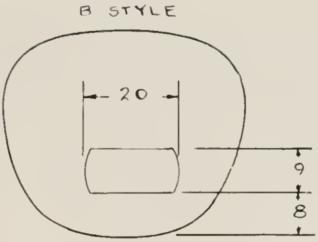


FIG 7

R SEGMENT

The R style segment has two major functions.

1—Large reading field.
2—Prism control.

Although its standard dimension is 22 x 14 it can be obtained as wide as 25mm without special order. Its vertical height remains constant at 14mm. Because it has no wasted areas at the top or bottom, it provides maximum reading field with minimum encroachment on the distance area.

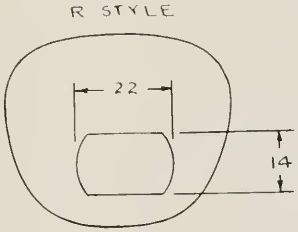


FIG 8

Because of its distinctive shape, it has been widely used by practitioners who want to avoid the price competitive field of the standard D style.

It has slightly more jump than the D type because its O.C. is farther below the top of the seg, but this has not proved to be a problem.

Its more important use has been in the area of prism control. The standard R style can be so ground so as to produce base up or base down prism in the segment by varying the length of the top and bottom lines.

In cases of anisometropia where a difference exists between the distance Rx of the O.D. and O.S. significant enough to produce a prism imbalance at the reading level, it is often practical to compensate for this imbalance by prescribing prism in the segments. Where the amount of vertical imbalance does not exceed 1.5 prism diopters, the compensated R provides a very practical solution. The numbers above the segment in Fig. 9 indicate the distance below the top line of the optical center in each segment.

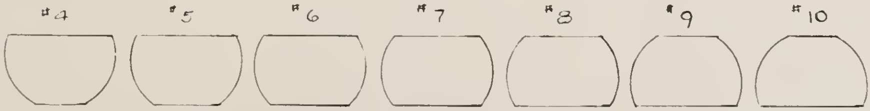
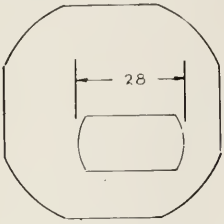


FIG 9

If the reading addition was + 2.00 and a vertical prism imbalance of 1 prism diopter was to be corrected, the selection of a No. 4 shape in one eye and a No. 10 in the other would provide it. The difference in O.C. positions provide a decentration of 5mm. A 2.00 sphere decentered 5mm produces the desired 1 prism diopter.

For amounts over 1.5 prism diopters, a slab-off or bicentric prism is recommended. For further information on the entire subject of vertical prism compensation for near seeing, it will be necessary to read special treatises on this subject.

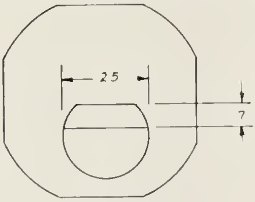


X - R FIG 10

The R style segment also provides a means of obtaining lateral prism in the seg. In cases where base-in is required in the seg, the X-R segment is recommended. This seg is made 28mm long, in semi-rough form. By proper layout in the laboratory, the segment can be decentered to produce the desired amount of prism.

In a 2.00 add, a 5mm decentration in of the seg will produce 1 prism diopter base-in and still provide adequate reading field.

THE TRIFOCAL OR 3-WAY



7 x 25 TRIFOCAL
FIG. 11

The fastest growing seg in the entire multifocal field is the trifocal. It has been determined that *any* presbyope who requires more than a + 1.50 reading addition will obtain more comfortable and adequate vision with this lens than with a bifocal. Actually, it is impossible for a patient in this class to get maximum performance from his eyes without one. The bifocal in adds over + 1.50 is inadequate and should never be prescribed any more than a person requiring a cylindrical component should be fitted with a sphere.

The amount of amplitude of accommodation determines the reading addition. It is agreed, in general, that a patient can use ½ of his amplitude for near seeing; must keep the other ½ in reserve.

When a person reads at 16″, he requires 2.50 D of accommodation. (40″ ÷ 16″)

If his amplitude measures 5 D, he can use ½ or 2.50 D. Therefore, a person with a 5 D amp would require no reading add.

If his amp drops to 4.0 D, he can use ½ or 2.0 D. If he needs 2.5 D to see at 16″, he would then require a + 0.50 add for near.

If his amp drops to 3.0 D, he can use ½ or 1.50 D. He then needs a + 1.00 add to give him his required 2.5 D at 16″.

When his amp drops to 2.0 D he can use ½ or 1.0 D. He then requires a + 1.50 add to give him his required + 2.50 D to read at 16″.

At this point, we must take another factor into consideration.

Consider again, the patient with an amplitude of accommodation of 2.00 D. It is known he can use all of it for far seeing, only ½ for near seeing.

His 2.0 D amp, when used for far seeing will permit him to see in as far as 20″. His ½ of the 2.0 D plus the 1.50 add for reading he has been supplied with, will permit him to see out as far as 16″.

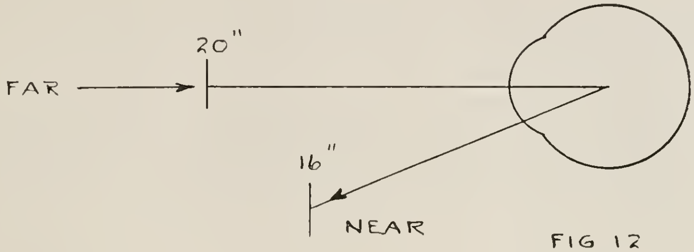


FIG 12

Obviously, then, he has a theoretical "no man's land" of 4″. He cannot see in any closer than 20″ through his distance lens nor any farther out than 16″ with his reading forms.

We therefore can see that when the amplitude of accommodation drops to 2.0 D, a new problem develops. Fortunately, and from a practical point of view, these 4 inches of "no man's land" are not too troublesome. In the average case, a slight movement forward will bring the area into adequate focus for most people. There are some cases, however, due to occupational demands, that this compensation is not possible. In this case, some means of mechanical compensation must be provided.

Let us now consider the person with an amplitude of accommodation of only 1.50 D. He can use the full amount for distance seeing but only ½ for reading. Therefore, he has only 0.75 D available to see at 16″ which requires 2.50 D. He therefore is given a + 1.75 D add.

His 1.50 D amp will permit him to see in as far as 26″ (40″ ÷ 1.5 D). With his + 1.75 reading add and the 0.75 D of amplitude (½ of 1.50) he can see out as far as 16″ for his near task.

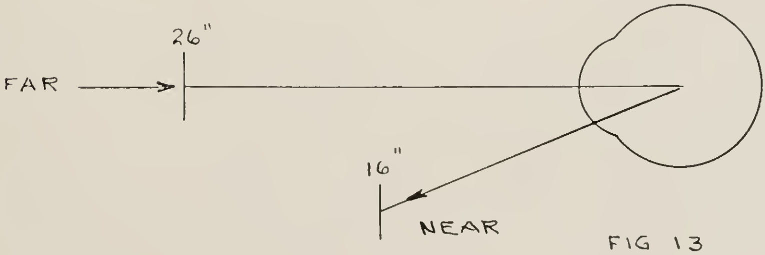


FIG 13

Obviously, he now has a "no man's land" of 10 inches. It is generally conceded that this is far too great a distance for patient compensation and that if only a bifocal is prescribed, inadequate vision is the result.

As the amplitude of accommodation drops below 1.5 D as it does with increasing age, and stronger reading adds are required this condition worsens.

Therefore, it can be said that whenever the amplitude of accommodation drops to 1.5 D or lower or a + 1.75 add or more for reading is needed, some mechanical compensation for the "no man's land" condition is indicated and needed.

This mechanical compensation is the intermediate field of a trifocal.

Placed immediately above the reading segment, it is in the proper position to provide an intermediate reading area at the required distance.

It need not be of large size.

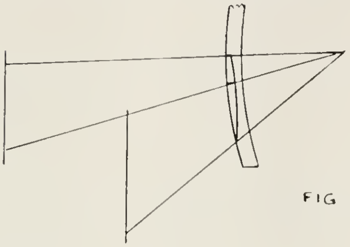


FIG 14

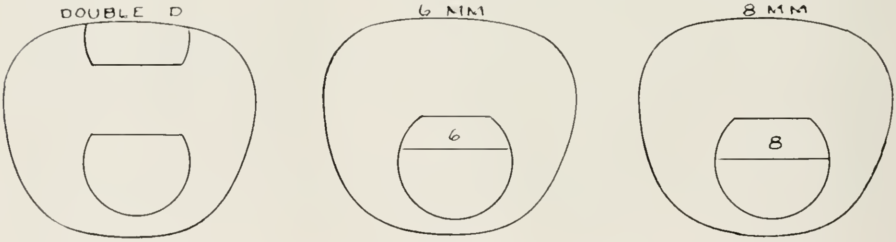
As can be seen from Fig. 14, the greater distance at which the intermediate is used provides a large field as compared with the shorter distance at which the larger reading segment is used.

The optimum size for general purposes has been found to be 7mm in the vertical measurement.

To provide a maximum lateral area at intermediate, it has been determined that a 25mm seg at the reading seg center allows all of the lateral field necessary.

The power of the intermediate segment is always 50% of the reading add. This too has been found to be best for general purposes.

Other segment sizes and intermediate powers are available, however, for special vocational uses. These are described in detail in other material.



DOUBLE D

6 MM

8 MM

FIG 15

Trifocal failures are almost always traceable to improper fitting. The tendency is always to fit them too low. Because they are used primarily for reading at near, first consideration should be given the position of the top of the reading seg. It has been found that the optimum position places the top of the reading seg at the same height as in an ordinary bifocal, letting the intermediate fall where it may. In other words, the top of the intermediate should be ordered 7mm higher than a regular D style seg. An excellent reference point is the lower margin of the pupil. The top of the intermediate should just reach it.

LENTICULAR CATARACTS.

Shuron provides a Single Vision, Bifocal and Trifocal Lenticular Cataract.

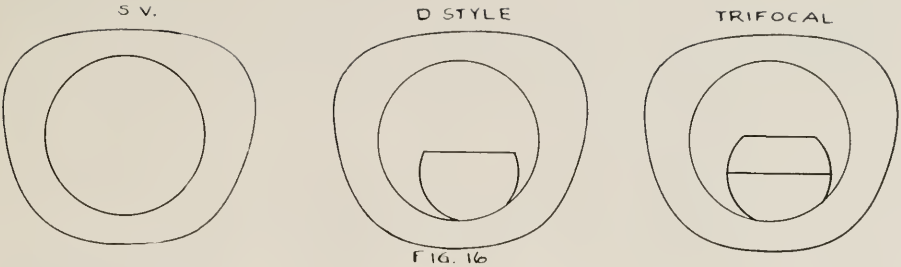


FIG. 16

All are designed to materially reduce the weight and thickness of cataract Rxs. They provide a thin, lightweight group of lenses, all manufactured to the closest precision lens standards possible. Cataract prescription and fitting is a special subject and other material is available on this subject of a much more detailed nature.

CONSTRUCTION

As in the case of Widesite Single Vision construction, features of the Shuron Multifocal product make it superior to any other product on the market.

Probably the outstanding feature of the blank is its amazing consistency of add accuracy and its definition of image. These features are due to the preparation of the contact surfaces of the button and the countersink and their subsequent fusion.

To more thoroughly understand this process and its advantages, let us examine the process common to most multifocals and analyze the deficiencies produced by such processing. All fused Multifocals are produced by fusing a simple (in a Kryptok) or a composite (improved) button, of higher refractive index, to a major crown blank.

In the average lens, considerable variation between the curvature of the two parts is purposely developed. This is to provide a means to expel the air layer between the two parts and thus eliminate bubbles, which are cause for rejection in the finished product.

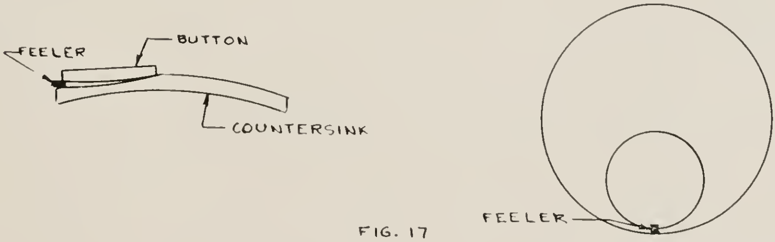


FIG. 17

As can be seen in Fig. 17, this variation of curvature, which may be as great as 1.00 D, makes possible the insertion of a lead feeler, having a low melting point. The blank is then heated so that the segment glass softens and actually "flows," pushing the air out ahead of it. This process produces fusion and in general, eliminates bubbles of air and other inclusions. However, it obviously produces distortions that impair the quality of the segment section.

These distortions take many forms.

1—Cylinder in the segment—a common fault. Witness the "egg shaped" Kryp.
2—Off add. Reading adds are hard to control within accurate focus range.
3—Impairment of image—poor definition and poor depth of field. Aberration produced by excessive heat in fusion.

Generally, the preparation of these fusing interfaces is not good, as it need not be. Any properly prepared surface, fused under above circumstances would be destroyed in the fusing process anyway.

The approach to fusion of the button and countersink in Shuron Multifocals is entirely different. All fusion surfaces are very carefully prepared from a grinding and polishing point of view but most important, are ground to exact accuracy. Each countersink and button surface must pass a Newton Ring test, a form of measuring device that permits checking of surface accuracy to within extremely close limits. Actually, the measurement checks within wavelengths of light rather than fractions of a dioptre; by comparison, a very crude measurement.

The Newton Ring Test not only measures accuracy of curvature but also surface contour. Any variation from a perfect sphere will result in elliptical rings instead of round ones. So this test guarantees not only an accurate surface but one that is perfectly spherical.

The purpose of this close control is to insure that when button and countersink are assembled, no variation of curvature exists as it does in Fig. 17. It is now possible to bring about fusion of the two parts at a much lower temperature than in any other process. Actually, a minimum heat is now possible to just "Weld" rather than fuse. The glass is brought to the "Threshold"—the minimum heat needed to weld the two parts together. This is in contrast to the actual glass "flowing" that takes place in ordinary fusion. A simple demonstration of this "Threshold Welding" can be made by comparing the edge and surface condition of 2 countersinks, one which has been subjected to ordinary fusing temperatures and the other, to Threshold Welding.

Threshold Welding eliminates the deviations found in other lenses. The process is lengthy, costly and time-consuming but produces a superior product.

1—Segments are free from unwanted cylinder.
2—Adds are accurate. .06 D deviation is maximum allowed.
3—Sharp definition of image. Compare the clarity and sharpness of the mires of a vertometer, add for add, with other lenses.
4—Greater depth of focus. Notice the increased range of power on either side of the focal point of the add.

In Shuron Multifocals, we have a measureable difference in the above factors, all of which add up to better vision for the patient and trouble free prescriptions for the doctor. For the laboratory, a minimum of do-overs, improved service and justification of higher Rx prices for better workmanship.

SEGMENT SIZES.

Shuron semi-finished Multifocals are supplied in paired boxes and segs are matched within 0.25mm. No need to hunt through stock to find matched segs.

CONTOUR QUALITY.

Grinding and polishing processes make it possible for these lenses to pass the arc lamp test, insuring perfect spherical surfaces on the segment side.

SURFACE QUALITY.

No pits, scratches, grey or other "beauty" marks are passable.

THIN, NON REFLECTIVE TOP LINE.

The top lines of all Shuron Multifocals are specially treated to produce a grey, non reflective line. No reflection into the patient's eye and a minimum visibility to both patient and observer. Special high index glass provides shallow, thin seg.

COLOR FREE.

Special "AKRO" seg glass provides a minimum color aberration in standard 20 and 22mm segs. Larger segs produce some color aberration as in the case of *all* color-free types.

CORRECTED CURVES.

The greatest ranges of base curves in the multifocal field is available. Base curves range from plano base to + 16.00 in properly compensated curves, to provide maximum correction.

In brief, the Shuron Multifocal product being provided gives laboratory and professional man the opportunity to provide the widest possible area of service in types of lens, quality and range of color and curvature that can be made.

The laboratory will improve its service, reduce its costs and increase its profit.

The professional man has at his disposal, the widest possible range of multifocal tools to provide maximum correction to his patient.

The patient cannot obtain better or more comfortable vision.

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